

EXPERIMENTAL STUDY ON BAGASSE ASH AND RECYCLED AGGREGATE IN CONCRETE

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Abstract— This paper deals with the review of existing literature work of used of waste material in concrete like crush sand, recycle aggregate and bagasse ash. The potential utilization of waste materials in concrete manufacture provides a satisfactory solution to some of the environmental concerns and problems associated with waste management. Agriculture wastes such as rice husk ash, wheat straw ash and sugarcane bagasse ash are used as pozzolanic materials for the development of blended cements. And replacement of natural aggregate by recycled aggregate and natural sand by crushed sand. Studies have been reported on the use of bagasse ash (BA) as partial cement replacement material in respect of cement mortars. In this study, the effects of BA content as partial replacement of cement on physical and mechanical properties of concrete will be investigated. The properties of concrete to be studied include workability compressive strength, water absorption, permeability characteristics, chloride diffusion and resistance to chloride ion penetration. The recycling of concrete aggregate has been accepted to save natural aggregate for other important use. In many developed country it is used as a replace of natural aggregate. Also many practical experiments show's that natural aggregate can be replaced by recycle aggregate and can be used for construction purposes

Index Terms— Recycle Aggregate, Bagasse Ash, Crush Sand.

I. INTRODUCTION

In the modern civilized world, due to growing population and life demand the construction of building sand infrastructures have been increased rapidly. Among the other construction materials, concrete is one of the most versatile and widely used man-made building materials and has gained popularity for its multiple advantages: easiest manufacturing procedure, strength and durability properties at normal environment. For the development and urbanization of the society, it plays a prime role in many aspects of everyday life - from the buildings we work and live in, to the roads, tunnels, bridges and railways that transport us. It is considered as a key element in the social and economic wellbeing for the human being.

Nowadays, for the concrete production, the majority of the commonly used cement is ordinary Portland cement (OPC) and PPC, the cost of cement is continuously rising and natural resources are reducing (such as clinker). Cement acts as the main ingredient for the production of concrete. The demand of cement is increasing day by day for the mentioned reasons. During the cement production, clinker is burnt at about 1450 degree Celsius (Neville, 1995) consequently huge amount of CO₂ is emitted into the atmosphere. Hence temperature of the globe is increasing which is one of the reasons for climate change. About 7% of world's CO₂ is produced for the manufacturing of cement. In consequence, global warming is increasing continuously. To solve these, researches in cement and concrete technology have been concentrated to use the waste material as a potential alternative in the construction industry.

Crushed Sand: Few studies had been conducted in the past to investigate the effect of partial replacement of Natural River sand with crushed rock sand. The cost of concrete production primarily depends upon the cost of its constituent raw materials namely cement, aggregates (course and fine) and water. Among the constituent raw materials, the Natural River sand which occurs near about 35% of the concrete volume plays an important role in deciding the cost of concrete. Crushed rock sand has surfaced as 110 viable alternative to Natural River sand and is being now used commonly throughout the world as fine aggregate in concrete. It is manufactured by crushing the quarried stone to a size that will completely pass through 4.75 mm sieve.

Recycled Aggregates: Construction and demolitions are the procedures that work simultaneously. The demolished building rubble in India generally goes to waste in landfills and affect the fertility of land. After few years building and demolition waste will be more than half of the National total waste in most nations of the world so recycling of these concrete waste materials from building demolition can provide a best way to reuse waste materials.

In construction field concrete is main construction material across the world and is mostly used in all types of civil engineering works. An aggregate represents about 70-80% of concrete components so it will be beneficial to recycle the aggregate for construction works and also to solve the environmental problems. The Cost of Recycled Concrete Aggregate may be less than 20 to 30 % less than natural aggregate in some Regions.

Bagasse Ash: Bagasse is a major by-product of the sugar industry, which is utilized in the same industry as an energy source for sugar production. Sugarcane contains 25–30% bagasse, whereas industry recovered sugar is about 10%. Bagasse is also used as a raw material for paper making because of its fibrous texture, and about 0.3 tons of paper can be made from one ton of bagasse. In Pakistan, approximately 70 sugar mills produce an estimated 14 million tons of bagasse annually, which is mainly used as an energy source. Burning bagasse leaves 3% ash, which has no use other than landfills. The silica content of pozzolans reacts with free lime released during the hydration of cement and forms additional calcium silicate hydrate (CSH) as new hydration products which improves the mechanical properties of concrete formation. The ash produced by the controlled burning of agro waste materials below 700°C incinerating temperature for 1 h transforms the silica content of the ash into an amorphous phase and the reactivity of amorphous silica is directly proportional to the specific surface area of ash. The ash so produced is pulverized or ground to the required fineness, then mixed with cement to produce blended cement. Thus, the agricultural ash properties depend on burning time, temperature, cooling time, and grinding conditions.

II. OBJECTIVES:

These are the objectives of this paper

- To investigate the properties of CaO blended bagasse ash.
- To replace natural coarse aggregate by the recycled coarse aggregate in various percentages.
- To study and compare the mechanical properties, compressive strength, tensile strength, flexural.
- Strength of hardened concrete specimens with and without recycled aggregates.
- To study strength properties after replacement of natural sand by crushed sand.

III. LITERATURE SURVEY

B. K. Baguant [1] the technical feasibility of using bagasse ash as a partial replacement of cement in concrete (i.e., as a pozzolana), and as a fine aggregate in concrete. The low chemical reactivity of the ash is demonstrated. Its use as sand in concrete shows no adverse effects on strength or strength development up to one year. However, the longer-term properties of the concrete, such as shrinkage and durability need to be further investigated and concluded that Bagasse ash can be effectively used as a fine aggregate in concrete to produce a range of compressive strengths up to about 70 N/mm².

K. Ganesan [2] studied the effects of BA content as partial replacement of cement on physical and mechanical properties of hardened concrete. The properties of concrete studied include compressive strength, water absorption, permeability characteristics, chloride diffusion and resistance to chloride ion penetration and stated that up to 20% of ordinary Portland cement can be optimally replaced with well-burnt bagasse ash without any adverse effect on the desirable properties of concrete. The specific advantages of such replacement include Development of high early strength, reduction in water permeability and appreciable resistance to chloride permeation and diffusion.

Nor-ul-amin [3] used bagasse ash as a raw material to design a high strength Portland cement and was subjected to clinkerization and cement formation. The results indicated that the 5% bagasse ash was found to as the optimal limit to be blended and pulverized with other raw material prior to clinkerization.

Prof. Dharmesh.k. Bhagat [4] from their study it can be concluded that, RCA exhibits comparatively less specific gravity than NA. As the water absorption of RCA was found greater than NA, because of adhering mortar and cement paste. Also their result for compressive strength tells that, the use of RCA up to 40% affect the functional requirements of concrete structure.

Vinod Sunhere [5] studied and their test results suggest that as the percentage of Natural Aggregate decreases by replacing the Recycled Concrete Aggregate, the corresponding strength goes on decreasing, yet up to 60% replacement it achieves target mean strength.

Akansha Tiwari [6] studied about water absorption of RCA and founded that water absorption is higher than the natural aggregate also the compressive strength of concrete containing 50% of RCA has strength approximately to that of normal concrete. Also her study tells that Concrete has good tensile strength when replaced up to 25-30%.

Dan Ravina [7] investigated the use of crushed sand as fine aggregates along with Fly. He said that the particle shape of crushed sand is more angular with a rougher surface texture, and usually flakier and more elongated than of natural sand. Moreover the crushed sand, unless suitably treated, contains much more fines (particles smaller than 75 mm). As a result the workability of the fresh concrete is impaired with the corresponding need for higher water requirement which in turn makes for lower concrete strength and higher drying shrinkage. By contrast, the fly ash particle has a round shape and a smooth surface. He says that a combination of fly ash and crushed sand yield a far superior concrete mix than crushed sand alone' and obviates the disadvantage of partial or total replacement of natural sand with crushed sand. According to 'Dan Ravina' we can use crush sand as a replacement in place of natural sand which is the cheapest way for replacement and having no drawbacks.

B Balagol & SA Kulkarni [8] studied the hardened properties of concrete with use of crushed basalt stone fine aggregate as a substitute to natural sand. The researchers concluded that there was significant increase in compressive strength with crushed sand. The compressive strength was increased by 19.44% to 40.38% at 7 days age and increased by 8.33% to 25.9% at 28 days age as grade of increased mixes was increased. The flexural strength of concrete with crushed sand was marginally increased about 1 to 5% as compared to natural sand. According to B Balanglo & SA Kulkarni crush sand gives more strength than natural sand of properties of crush sand i.e. shape size, strength etc. It gives higher strength than that of natural sand.

IV. CONCLUSION:

On the basis of literature review following conclusions can be drawn:

- Recycled aggregate can be used with natural aggregate and we achieve 80 -90% strength.
- It is possible to produce high-strength concrete with the combination of the finely ground bagasse ash.
- Surface resistivity of bagasse ash replaced with cement was found to be higher as compared to normal concrete.
- Up to 10-15% bagasse ash can be replaced by cement.
- Recycled aggregate will promote sustainable growth.
- Crushed sand can be replaced 100% by natural sand.
- Recycled aggregate will reduce burden on natural aggregate i.e. natural aggregate can be used for important purpose.
- Due to use of recycled aggregate in construction industry it can slow the impact of waste environment.
- Concrete with bagasse ash replacement showed equal or marginally better strength performance compared to control concrete, even at 3 days. The results clearly indicate that concrete of the same grade can be produced with up to 25% replacement of cement by SCBA.
- Concrete using fine recycled aggregate, as long as these are applied with special precaution (e.g. compensation of the water absorbed by fine RA, strict limitation of the replacement levels, careful control of the quality of the original material).
- Despite lack of information on multiple recycling of concrete, studies suggest that these can be subjected to a high number of recycling cycles without demonstrating a significant loss in performance.

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